

**REMARKS**

This Amendment is intended as a full and complete response to the Office Action dated April 22, 2009. In this Amendment, Claims 1, 4 and 5 are canceled; new Claims 15-20 are added; and Claims 2, 3, 6, 7, 10, 12 and 14 include clarifying amendments.

Claim 15 is a new independent claim, and claims 2, 3, 6, 7, 10, 12 and 14 have been amended to recite dependency from Claim 15 instead of now-canceled Claim 1. In addition, Claims 10 and 12 have been amended to address the Examiner's rejection under 35 U.S.C. § 112, second paragraph, by amending "extractive agent" to recite the intended reagent, --reactive extractive agent--.

New independent Claims 15 and 19 are presented to more particularly point out the present invention. Claim 15 is similar to canceled Claim 1, and also specifically denotes the reagents and combinations thereof used as the reactive extractive reagents. Claim 19 is directed to a process for targeting organosulfur compounds using a hypochlorite as a reactive extractive agent, and specifies part of the reaction chemistry in which chlorosulfonium ions are present as a water soluble product. New dependent claims 16, 17 and 18 are directed to certain specific reactive extractive agents. New dependent claim 20 includes a limitation based on the reaction pathway.

Therefore, Claims 2-3 and 6-20 remain for examination. No new matter is added by these amendments or introduced with the new claims, and their entry and favorable reconsideration is respectfully requested.

## **THE CLAIMED INVENTION**

It is very well established that removal of sulfur compounds from hydrocarbons is an important undertaking. The present invention provides an alternative or complementary process to remove sulfur compounds from hydrocarbon streams using a newly discovered reaction chemistry involving conversion of sulfur compounds into ionic species which are completely soluble in water. As is very well known to those having ordinary skill in the chemical arts, ions are soluble in water, and essentially, or not at all soluble, i.e., they are insoluble, in hydrocarbon liquids. Therefore, the present invention represents a substantial improvement and significant contribution to the desulfurization arts.

## **THE REJECTIONS OF CLAIMS UNDER 35 U.S.C. §102 & 35 U.S.C. §103 ARE UNTENABLE IN LIGHT OF THE CLAIM AMENDMENTS**

Claims 1-14 were variously rejected in the Office Action of April 22, 2009 under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a). In particular:

- Claims 1-3, 6, 10, 12 and 14 were rejected under 35 U.S.C. § 102(b) as being anticipated by Ou U.S. Patent No. 5,167,797 (hereinafter “Ou”);
- Claims 4 and 5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ou in view of Oakes U.S. Patent No. 4,473,115; and
- Claims 7-9, 11 and 13 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ou in view of Eberly, Jr. U.S. Patent No. 4,592,829.

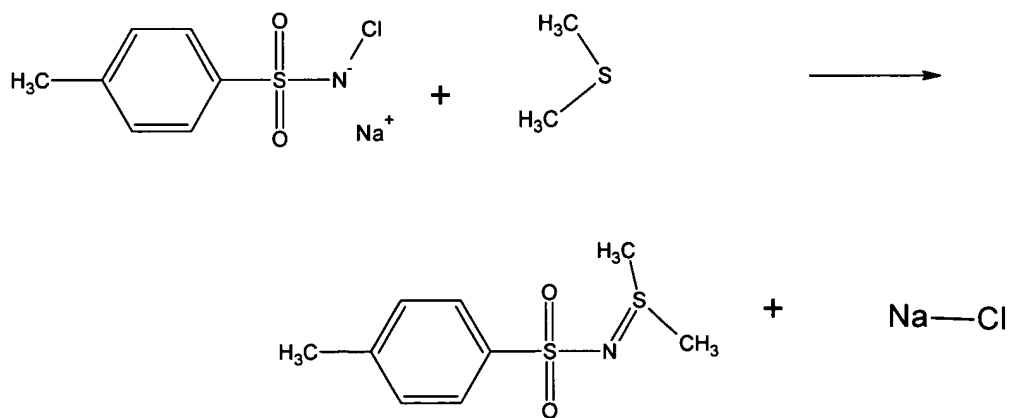
Applicants respectfully traverse all of the grounds of rejection set forth under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a), and submit that the amendments and additional explanation and arguments presented herein overcome the rejections.

## SUMMARY OF THE PRIMARY CITED REFERENCES

*Ou U.S. Patent No. 5,167,797*

The Ou reference was relied upon in the Office Action to reject all of the claims, in particular, under 35 U.S.C. § 102(b) with respect to Claims 1-3, 6, 10, 12 and 14, and under 35 U.S.C. § 103(a) with respect to Claims 4,5, 7-9, 11 and 13. It is noted that Applicants were fully aware of this reference, as it was disclosed in the Information Disclosure Statement filed on February 8, 2008, and discussed in the Background of the Invention section of the application, at page 7, lines 6-17.

In general, Ou describes a reaction between organosulfur compounds and N-halogeno compounds, such as N-haloamines. The N-haloamines class of reagents, including chloramine-T, react with organic sulfides, disulfides, mercaptans and thioethers to produce sulfilimines through a sulfonium cation intermediate. For example, chloramine-T reacts with dimethyl sulfide to form S,S-dimethyl-N-(p-toluensulfonyl)-sulfilimine and sodium chloride:



Sulfilimine products formed as reaction products of N-haloamines such as chloramine-T and organic sulfides, mercaptans, thioethers, or disulfides remain soluble in hydrocarbons and so must still be removed from the hydrocarbon stream by treatment of that stream with a water

extraction process or by an adsorbent. This is evident from the relevant passage in the Ou specification which discusses the solubility of the reaction products:

“...some of the N-halogeno compounds and their reaction products of N-halogeno-sulfur compounds are more soluble in water, than in paraffins, olefins or aromatics.” (Ou, c. 3, ll. 39-41).

This statement clearly indicates that the reaction products and the reagents are not only soluble in water, but are also soluble in the hydrocarbon liquids. As discussed in further detail below, this reaction scheme is quite different that the reaction chemistry of the present invention, in which the reaction products are ionic species that are insoluble in hydrocarbon liquids.

*Oakes U.S. Patent No. 4,473,115*

The Oakes reference was relied upon in the Office Action for the rejection of Claims 4 and 5. In the instant amendment, Claims 4 and 5 are canceled. Claims 16 and 17 recite compounds similar to those of original Claims 4 and 5, but are of different scope. In particular, Claim 16 specifies the types of hypochlorites. Claim 17 adds, in combination with the agents of Claim 15, a salt or acid form of mixed oxides of chlorine selected from the group consisting of chlorous acid, perchloric acid, chlorine dioxide, and mixtures thereof.

The cited Oakes reference is directed to reducing hydrogen sulfide in the well bore by introducing a stabilized aqueous chlorine dioxide solution into the well bore to treat the subterranean well fluid and/or drilling mud. While the reaction chemistry is not specified in the Oakes reference, it is well known to those of ordinary skill in the art. The reaction produces sulfuric acid ( $\text{H}_2\text{SO}_4$ ) and colloidal elemental sulfur (S) as products, and hydrochloric acid (HCl) as a byproduct:



Therefore, the Oakes reference is not at all relevant to the present process and reaction schemes, particularly as presented in the amended and new claims. Rather, the claims presented in this Amendment are directed to an aqueous reactive extractive agent that reacts with the sulfur compounds to form ions. As amended, chlorine dioxide is only included in dependent Claim 17 as a possible additional component of the aqueous reactive extractive agent. In addition, Claim 3 has been amended to remove hydrogen sulfide as a specific targeted sulfur compound.

*Eberly, Jr. U.S. Patent No. 4,592,829*

The Eberly, Jr. reference was relied upon in the Office Action for the rejection of Claims 7-9, 11 and 13, and describes a process to remove organic sulfur compounds such as mercaptans, sulfides, thioethers, and disulfides from hydrocarbon streams by using an adsorbent or catalyst comprised of metallic nickel and iron, optionally supported on an inorganic oxide compound such as alumina. This reference is not at all concerned with catalysts for the purpose of promoting the reaction between a reactive extractive agent and sulfur compounds present in a hydrocarbon feed.

It is respectfully submitted that the combination of Eberly, Jr. and Ou as asserted by the Examiner does not make out even a *prima facie* case of obviousness against Claims 7-9, 11 and 13 for the reason that such a combination would result in a completely different process than that of the claims at issue. As proposed by the Examiner, one would carry out sulfur removal by reaction with N-halogeno compounds disclosed by Ou, followed by adsorption, as also disclosed in Ou, using catalytic sorbents as disclosed by Eberly, Jr. However, in the present Claims 7-9, 11 and 13, the catalyst is not a sorbent, for instance, in a separate adsorption step. Rather, the

catalyst serves the purpose of promoting the reaction of the reactive extractive agent with the sulfur compounds in the hydrocarbon phase. Reconsideration and withdrawal of this ground of rejection is respectfully requested.

#### **THE CLAIM REJECTIONS SHOULD BE WITHDRAWN**

Turning to the claim rejections in the instant application, Applicants believe that the above amendments and the following remarks will establish that any case of anticipation or *prima facie* case of obviousness raised has now been rebutted and that the rejections under §102 and §103 based on the cited references should be withdrawn.

In particular, with respect to new Claim 15 and the claims dependent therefrom, Ou does not in any way disclose or suggest a reactive extractive agent that comprises:

one or more hypochlorites;

cyanuric acid and/or salts of cyanuric acid;

one or more hypochlorites in combination with cyanuric acid and/or salts of cyanuric acid;

one or more hypochlorites in combination with alkali metal and/or alkaline earth metal hydroxides;

cyanuric acid and/or salts of cyanuric acid in combination with alkali metal and/or alkaline earth metal hydroxides; and

one or more hypochlorites in combination with cyanuric acid and/or salts of cyanuric acid, and alkali metal and/or alkaline earth metal hydroxides.

The only chlorine-containing compounds disclosed as reagents by Ou are N-halogeno compounds. These reagents will invariably form reaction products that are soluble in both the aqueous phase and the hydrocarbon phase, thereby necessitating further extraction steps. Thus,

the Ou disclosure does not meet the principal limitation of Applicants' process which requires the removal of the sulfur compound from the hydrocarbon. Instead, Ou would merely change the form of the sulfur compounds while leaving them in the hydrocarbon mixture.

Further, with respect to independent Claims 19 and its dependent claim 20, Ou does not in any way disclose or suggest a reactive extractive agent that includes a hypochlorite, whereby the reaction chemistry forms chlorosulfonium ions as reaction products which are soluble in water, and remove the sulfur from the hydrocarbon stream.

As such, it is submitted that Claims 15 and 19 are not anticipated by Ou. Since Ou does not disclose key limitations of these independent claims, even if the combination with Oakes and Eberly Jr. were proper combinations - which Applicants do not in any way concede - the requirement that all of the claim limitations are met does not lead to a proper determination of obviousness under 35 U.S.C. § 103. Furthermore, claims 2-3 and 6-14, 16-18 depend, either directly or indirectly, from independent Claim 15 and recite additional novel features. Likewise, Claim 20 depends from Claim 19. As such, and for at least the same reasons discussed above, it is submitted that these dependent claims also fully satisfy the requirements for patentability under 35 U.S.C. § 102 and 35 U.S.C. § 103. Therefore, withdrawal of the rejection is respectfully requested.

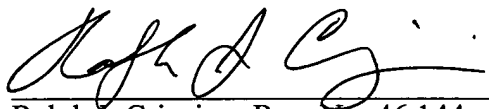
## **CONCLUSION**

In view of the amendments, analyses and arguments presented above, Applicants respectfully submit that this Amendment addresses all of the points raised in the Office Action and that all of the claims are in condition for allowance. Accordingly, both favorable reconsideration of this application and prompt issuance of a Notice of Allowance are earnestly solicited.

If, however, the Examiner believes that there are any unresolved issues concerning any of the claims, we respectfully request that the Examiner telephone Ralph J. Crispino at (212) 885-9358 or Thomas E. Spath at (212) 885-9250 so that appropriate actions can be taken as expeditiously as possible to resolve such issues.

The Commissioner is hereby authorized to charge any additional fees, or to credit any overpayment, due by reason of this paper to Deposit Account No. 01-0035.

Respectfully submitted,



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